



Incidence and mortality of breast cancer and Human development Index: An updated study on the Asian population in 2018

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General Note



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ABSTRACT

Objective: The incidence of breast cancer is rising rapidly and is a major concern for women's health worldwide. The aim of this study was to evaluate the epidemiology of incidence and mortality of breast cancer and its relation to the Human Development Index (HDI) in Asia in the year 2018. **Methods:** This is a descriptive-analytical study that is based on extraction of cancer incidence data and cancer mortality rates from the GLOBOCAN in 2018. The incidence and mortality rates and breast cancer distribution maps were drawn for Asia. To analyze data, the researchers used correlation test to evaluate the correlation between the incidence and mortality with HDI. The statistical analysis was carried out by Stata-14 and the significance level was estimated at the level of 0.05. **Materials and Methods:** The results of recorded cancer data in 2018 showed that Lebanon (97.6 per 100,000) had the highest incidence and Syrian Arab Republic (26.9 per 100,000) had the highest mortality rate in Asia. There was a significant positive correlation between the incidence rate ($R = 0.533$, $P < 0.0001$) and the HDI. Whereas, there was a negative poor correlation ($R = -0.02$, $P > 0.05$) between mortality of breast cancer with the HDI which was not statistically significant. In addition, a significant positive correlation was found between the incidence rate and GNI ($r = 0.32$, $P < 0.05$), MYS ($r = 0.403$, $P < 0.001$), LEB ($r = 0.613$, $P < 0.001$) and EYS ($r = 0.32$, $P < 0.05$). **Conclusion:** The incidence of breast cancer rises with the increase in the level of the HDI in Asia. On the other hand, the observed correlation between incidence rates and education level, gross national income and life expectancy may indicate that screening and early detection of the disease were higher in Asian countries than in countries with low HDI. There may be risk factors associated with higher incidence rates in these countries.

Keywords: Incidence, Mortality, Breast cancer, Human Development Index, World

1. INTRODUCTION

Non-communicable diseases (NCDs) are among the leading causes of death worldwide today. In recent years, cancer control has become a major public health challenge. Cancers are the leading cause of death in some developed countries and the second leading cause of death, after cardiovascular disease, in developing countries (Koohi and Salehiniya 2015). Population aging, increased life expectancy and urbanization have led to major changes in population structure and increased burden of non-communicable diseases, including cancers (Bray et al., 2018; Wong et al., 2017). Breast cancer is the most common cancer among women and the second cause of death in women aged 35-55 (Deshpande et al., 2013). It accounts for one-third of all cancers in women, the second most common after lung cancer and the most common cause of mortality in women. Considering the impact that breast cancer can have on patients' quality of life, its economic costs and mortality, it is among the cancers that require utmost attention (Gersten and Wilmoth, 2002; Omran, 2005).

In the United States, about 260 new cases are diagnosed each year (Panieri, 2012). Over the past decade, the incidence of breast cancer in the Eastern Mediterranean region has been 46%, increasing from 495,000 patients in 2005 to 723,000 in 2015 (Anna et al., 2013). In 2012, 1.7 million new cases of breast cancer were observed among women (Berek, Hacker and Hengst 2005; Karimi et al., 2014). According to a GLOBOCAN report, 18.1 million new cancer cases and 9.6 million breast cancer deaths were recorded as of 2018 (Pirasteh et al., 2013). According to the WHO, the incidence of the disease will increase from 1.8% to 2% annually, reaching 26% in developing countries by 2020. About 60 percent of breast cancer deaths occur in developing countries (Panieri, 2012). The incidence of breast cancer in developing countries is low but the mortality rate is higher (Parkin et al., 2005). Moreover, the overall rising trend of breast cancer incidence and death can be seen in all regions of the world across different social and economic levels (Mirfarhadi, Ghanbari and Rahimi, 2017). Socio-economic status is effective in the incidence of and mortality due to breast cancer (Kulhánová et al., 2017). Among the factors affecting the incidence and mortality rate of breast cancer is the HDI for each country. The HDI is a summary index for human development measurements. It measures the mean achievement of a country in three main dimensions of human development: long and healthy life, access to knowledge and living standards (Rafiemanesh et al., 2016).

The incidence of this breast cancer is higher in patients with higher HDI (Kulhánová et al., 2017). The incidence of breast cancer is increasing in developed countries. The burden of diseases caused by it are also increasing (Agarwal et al., 2009). According to a Pan American Health Organization report (2012) on the Human Development Index, in areas with a high HDI, the burden of diseases caused due to breast cancer is higher (Martínez-Mesa et al., 2017). Given the global trend of breast cancer and its progress in recent years, awareness of the incidence and mortality of this cancer and its relation to the HDI can be effective in planning and managing

financial and human resources to prevent it. The purpose of this study is to assess the impact of socioeconomic development (based on HDI) on the global trend of incidence and death of breast cancer in Asia based on World Bank data for 2018. In this study, we intend to study the key features of the epidemiology of breast cancer in Asia by examining the relationship between its incidence rate and the HDI, which consists of life expectancy, education, and gross national income.

2. MATERIALS AND METHODS

Incidence

The methods used for measuring incidence rate according to age and gender for each country are ranked broadly as follows:

National incidence rate monitored by 2018 (45 countries)

The most recent (national or regional) incidence rates according to population in 2018 (50 countries)

Rates were calculated using national mortality data through modeling and the ratio of mortality to incidence rate obtained from cancer records of countries (14 countries).

Rates were calculated using national mortality data through modeling and the ratio of mortality to incidence rate obtained from cancer records of neighboring countries (37 countries).

National incidence rates according to age and gender for all cancers were obtained by averaging the overall rates from neighboring countries. These values were then partitioned to obtain the national incidence for each specific site using relative cancer frequency data (7 countries).

The rates were calculated as the median of selected neighboring countries.

Mortality

The methods used for measuring incidence rate according to age and gender for each country are ranked as follows:

Observed national mortality rate by 2018 (81 countries)

Recent national mortality rates according to population in 2018 (20 countries)

Rates were calculated using national mortality data through modelling and the ratio of mortality to incidence rate obtained from cancer records of neighboring countries (81 countries).

The rates were calculated as the median of selected neighboring countries (three countries) (GLOBOCAN 2018, Engholm G, 2017).

HDI

HDI is a combination of three dimensions: Life expectancy, education, and access to the resources needed to lead a decent life. All groups and regions that have made significant progress in all components of the HDI have grown faster than countries with low or moderate HDI. As the index shows, the world is unequal because national means do not reflect the different experiences of individuals. There are numerous inequalities in the North and South, and income inequalities have increased in each country and between countries (Bray et al., 2012; Goodarzi et al., 2019; Khazaei et al., 2016, Programme).

Statistical analysis

In this study, the correlation bivariate method was used to assess the correlation between the incidence and mortality rates of breast cancer and the HDI. The significance level was considered lower than 0.05. The data analysis was conducted by Stata software version 14.

3. FINDINGS

According to the results obtained from the 2018 cancer records, 8622539 cases (182.6 per 100,000) were cancer and 4169387 (83.1 per 100,000) cancer deaths occurred in women. The highest incidence (208884 cases, 24.2% of all cancers) and mortality (626679 cases, 15%) was found in women with breast cancer worldwide. With 911014 new cases (43.6%) and 310577 cases (49.6%), Asia sees the highest incidence and mortality rate of breast cancer among other continents (Fig. 1).

The results of cancer data recorded in 2018 demonstrated that Lebanon (97.6 per 100,000), Cyprus (81.7 per 100,000) and Israel (78.5 per 100,000) experience the highest incidence rates, while the highest mortality rates are reported for the Syrian Arab Republic (26.9 per 100,000), Lebanon (25/25 / 100,000) and Pakistan (23/2 / 100,000). The results revealed that the incidence and mortality rates in over 45-year olds (279.9 per 100,000) and under 45-year olds are reported for Lebanon. The highest mortality rate was also observed in the age group above 45 years (83.5 per 100,000), While the highest mortality rates for the age group below 45 years was found for Syrian Arab Republic (7 per 100,000) (Table 1 and Fig. 2).

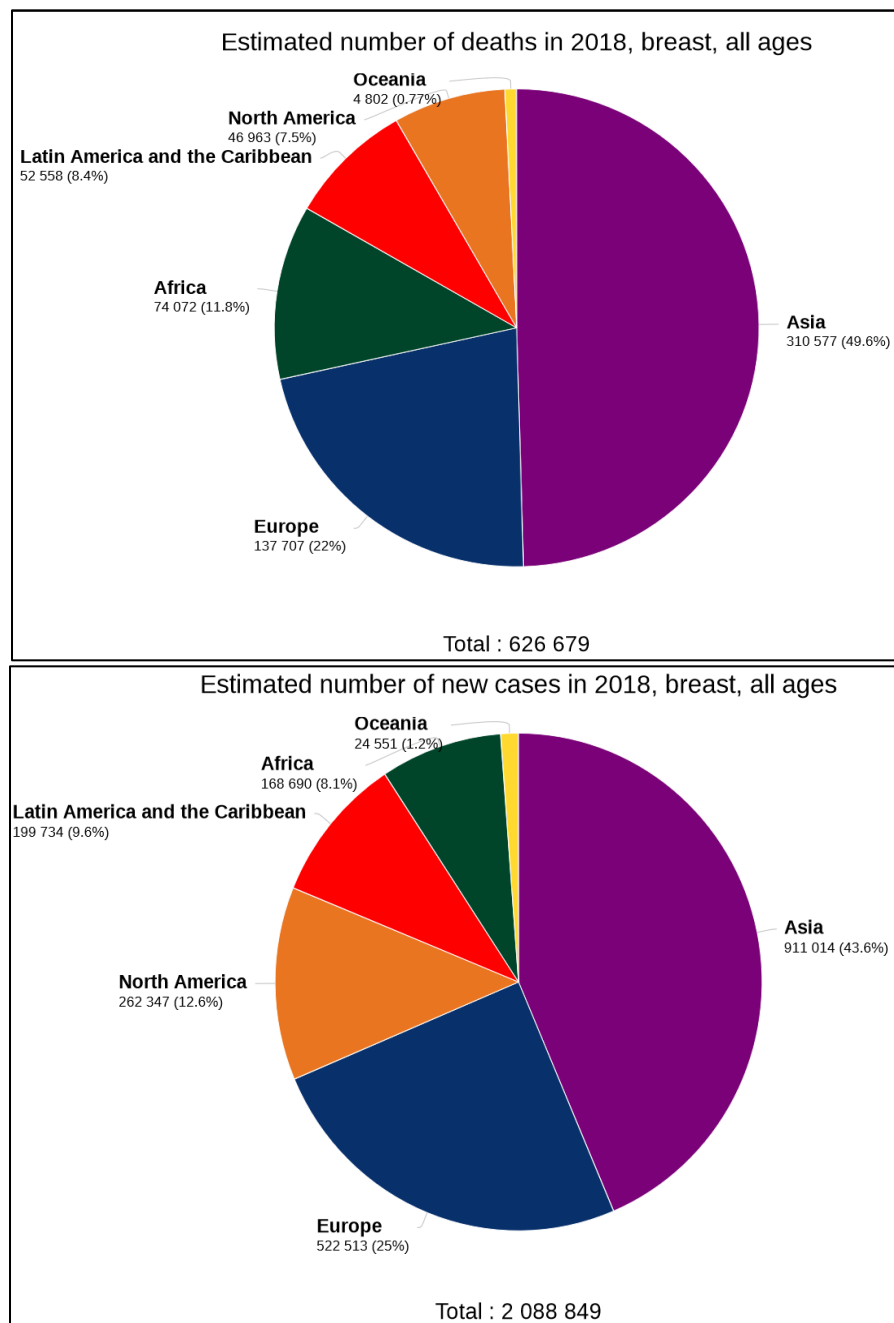
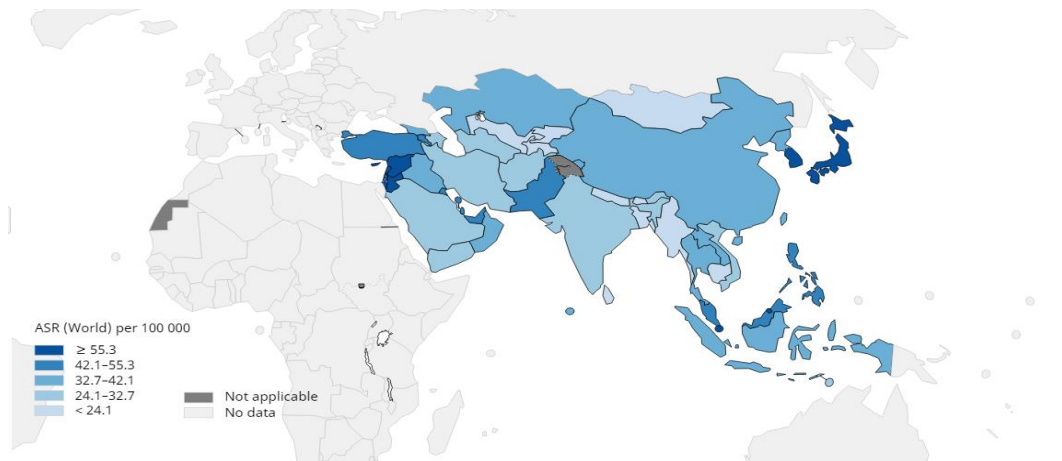


Figure 1 Pie charts present the distribution of cases and deaths by continent in 2018 for Males, all age. [Source: GLOBOCAN, 2018].

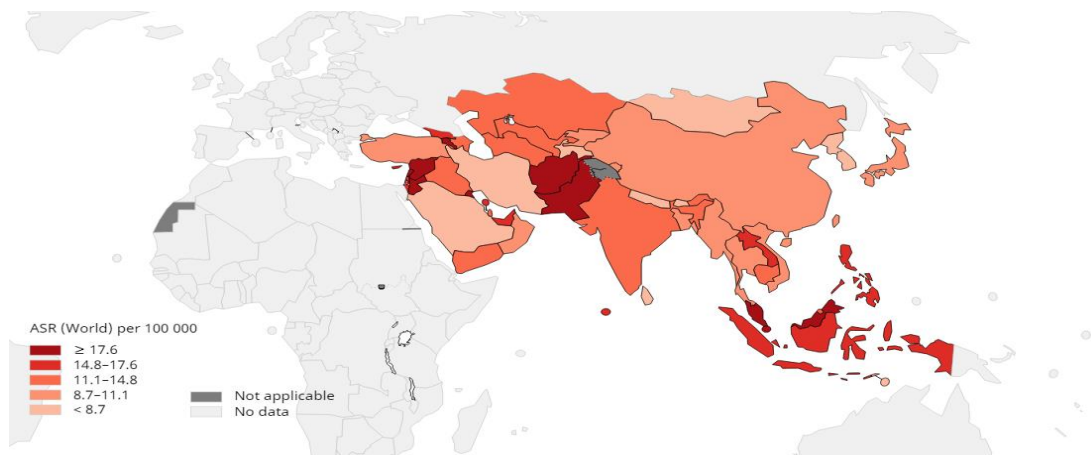
Table 1 Estimated age-standardized incidence and mortality rates for breast cancer in World in 2018

Country	Incidence Rate			Mortality Rate		
	44≤	≤45	Total	44≤	≤45	Total
Afghanistan	11.2	83.6	30.0	4.9	56.2	18.2
Armenia	7.5	145.1	43.3	2.0	73.5	20.6
Azerbaijan	8.9	100.4	32.7	2.5	49.2	14.6
Bahrain	10.9	138.6	44.1	2.2	50.9	14.9
Bangladesh	5.4	49.9	17.0	2.3	29.3	9.3
Bhutan	2.3	12.9	5.0	0.62	8.8	2.7
Brunei	16.4	171.7	56.8	1.4	39.0	11.2
Cambodia	5.3	68.4	21.7	1.9	39.2	11.6
China	13.2	101.3	36.1	0.98	30.9	8.8

Cyprus	22.7	249.7	81.7	1.8	59.6	16.9
Gaza Strip and West Bank	17.0	169.2	56.6	4.3	71.2	21.7
Georgia	9.0	105.2	34.0	2.5	54.1	15.9
India	7.6	73.1	24.7	2.6	44.4	13.4
Indonesia	13.2	124.2	42.1	3.1	56.4	17.0
Iran, Islamic Republic of	12.7	83.1	31.0	2.0	28.0	8.7
Iraq	13.7	108.5	38.4	3.6	41.9	13.6
Israel	20.3	244.4	78.5	2.4	56.8	16.6
Japan	21.1	161.6	57.6	1.4	31.9	9.3
Jordan	18.0	169.7	57.4	4.1	59.6	18.5
Kazakhstan	8.7	118.1	37.2	2.2	50.6	14.8
Korea, Democratic Republic of	12.5	90.8	32.8	1.4	22.3	6.8
Korea, Republic of	27.7	151.2	59.8	1.6	18.7	6.0
Kuwait	9.1	179.3	53.4	1.6	63.1	17.6
Kyrgyzstan	7.7	69.1	23.7	1.9	33.9	10.2
Lao People's Democratic Republic	8.3	102.2	32.7	2.4	55.4	16.2
Lebanon	33.5	279.9	97.6	6.0	80.3	25.3
Malaysia	14.6	141.1	47.5	3.5	60.9	18.4
Maldives	13.4	120.4	41.2	2.7	55.9	16.6
Mongolia	3.6	33.3	11.3	0.76	13.1	4.0
Myanmar	8.4	57.1	21.0	2.5	32.1	10.2
Nepal	5.7	41.2	15.0	1.9	29.3	7.6
Oman	13.5	94.8	34.7	3.3	32.8	11.0
Pakistan	15.5	124.9	43.9	5.7	73.1	23.2
Philippines	13.3	163.7	52.4	2.4	60.6	17.5
Qatar	8.3	138.4	42.1	1.4	49.2	13.9
Saudi Arabia	10.7	74.7	27.3	2.0	23.1	7.5
Singapore	22.3	182.7	64.0	2.3	64.9	18.5
Sri Lanka	8.5	61.5	22.2	2.1	25.1	8.1
Syrian Arab Republic	25.0	187.6	67.3	7.0	83.5	26.9
Tajikistan	4.9	43.0	14.8	1.3	21.3	6.5
Thailand	10.4	107.6	35.7	3.7	31.4	10.9
Timor-Leste	7.7	73.7	24.9	1.6	28.2	8.5
Turkey	17.1	126.7	45.6	2.4	33.6	10.5
Turkmenistan	6.5	85.7	27.1	4.8	42.1	14.5
United Arab Emirates	11.7	170.1	52.9	2.2	58.9	16.9
Uzbekistan	5.6	71.2	22.6	2.8	37.6	11.8
Viet Nam	7.6	79.8	26.4	1.9	35.0	10.5
Yemen	12.4	60.6	24.9	4.4	36.2	12.7



a) Incidence rate



b) Mortality rate

Figure 2 The map of Asia presenting (A) incidence and (B) mortality rates due to breast cancer among women living in Asian countries in 2018. [Source: GLOBOCAN 2018].

There was a significant positive correlation between the incidence rate ($R = 0.533$, $P < 0.05$) and the HDI. Whereas, there was a negative poor correlation ($R = -0.02$, $P > 0.05$) between mortality of breast cancer with the HDI which was not statistically significant (Fig 3).

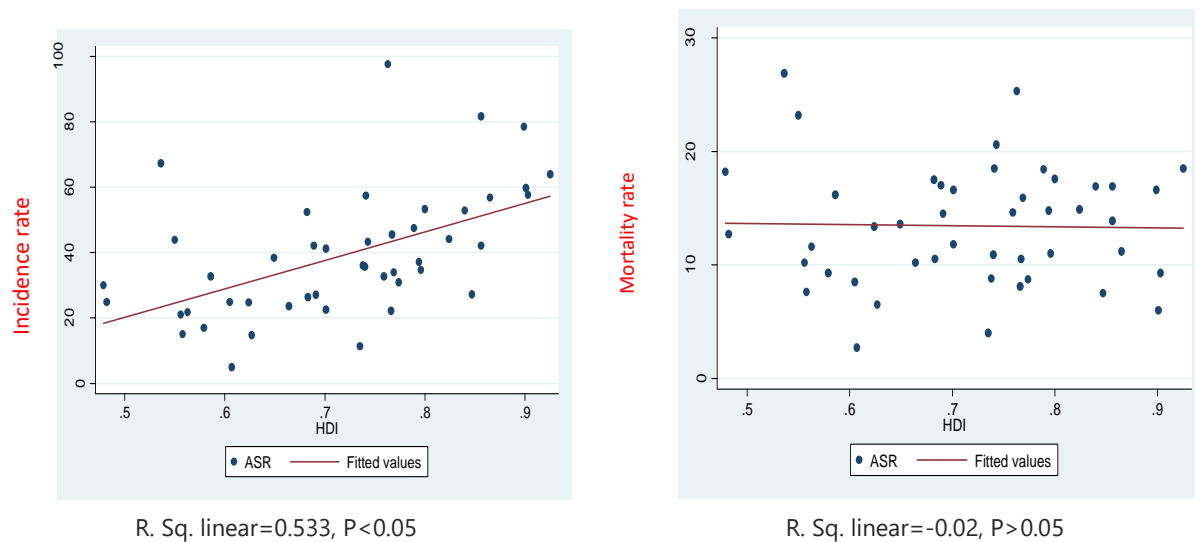


Figure 3 Correlation between the Human Development Index, incidence and mortality rates of breast cancer in Asia in 2018

Results showed a significant positive correlation between the incidence rate and GNI ($r = 0.32$, $P < 0.05$), MYS ($r = 0.403$, $P < 0.001$), LEB ($r = 0.613$, $P < 0.001$) and EYS ($r = 0.32$). There was no significant correlation between mortality and components of the HDI ($P > 0.05$) (Table 2).

Table 2 Pearson correlation between the HDI component and the dependent variable

HDI Components	ASIR*		ASMR*	
	r	P-value	r	P-value
Gross national income per 1000 capita	0.32	$P < 0.05$	0.019	$P > 0.05$
Mean years of schooling	0.403	$P < 0.001$	0.020	$P > 0.05$
Life expectancy at birth	0.613	$P < 0.001$	0.008	$P > 0.05$
Expected years of schooling	0.32	$P < 0.05$	0.-20	$P > 0.05$

*Dependent variables: ASIR and ASMR

4. DISCUSSION

Cancer records in 2018 showed that 43.6% of all breast cancers occur in Asia, with the highest incidence reported for Lebanon (97.6 per 100,000) and the highest rate of breast cancer deaths for Syrian Arab Republic (26.9 per 100,000) and Lebanon (25.3 per 100,000). Causes of high incidence may include screening, early detection, detection at early stages of the disease, and an accurate record system in these countries (Pakzad et al., 2015). The incidence rate of this cancer is low in developing countries. However, its mortality is reported to be high. Meanwhile, in developed countries, the incidence rate is high, but mortality is low (Parkin et al., 2005). In Brazil, the incidence of breast cancer is about a quarter of the United States. However, the increase in incidence rate is associated with an increase in breast cancer-related mortality (Chatenoud et al., 2010).

The results of our study showed a significant positive correlation between incidence rate ($R = 0.533$, $P < 0.0001$) and HDI in Asia. Meanwhile, a negative correlation was observed between mortality of breast cancer and HDI ($R = -0.02$, $P > 0.05$). A 2016 study by Ginsburg et al. showed that the incidence rate of breast cancer was not related to HDI (based on quality of life). However, it increases the relative rate and risk of breast cancer. Breast cancer is one of the most important factors for the affected families living in countries with high HDI. The mean age of diagnosis of breast cancer in Asian countries was 40-50 years and in Western countries 60-70 years (Sarker et al., 2016). A study by Mohammadian et al. in 2018 showed that there was a significant positive relationship between ASRI and HDI (Mohammadian et al., 2018). The study argues that cancer is still a major global concern in health communities, and extensive studies are required to understand the relationship between economic development and breast cancer.

Sharma's 2016 results demonstrated that the incidence of breast cancer was highest in people living in countries with high HDI. South Korea with a high HDI, China with a very high HDI, Indonesia with a moderate HDI and Nigeria with a low HDI show various breast cancer-related MIRs (mortality incidence rate). No significant correlation was found between HDI (income level) and breast cancer incidence (Sharma, 2019). The findings of this study are in line with our results. Socio-economic changes have had profound effects on cancer incidence and mortality. In countries with low or average incomes, the risk of cancers is increasing. Cancer-induced infections account for about 26% of cancers in low-income countries. Lifestyle changes, fewer births, inactivity, obesity are risk factors for breast cancer (Mahdavi et al. 2016). Breast cancer is linked to the industrialization of societies, and statistics show that most of the deaths from cancer have occurred in developing countries.

The reasons for a higher incidence of breast cancer in countries with higher HDIs include: good infrastructure (accurate registration system and access to primary health care), timely screening and diagnosis, preparation of treatment protocols, and easy access to health care. The causes for higher mortality in developing countries are lack of access to appropriate diagnostic and screening facilities, and a growing population. On the other hand, morbidity and mortality of different cancer types in different regions of the world follow a different pattern. They are associated with occupational, social, cultural, racial, geographic and nutritional factors and are directly related to the increase in countries' incomes (Organization). Women in Asian countries are partly committed (Organization, 2011) to their traditional lifestyles. However, the rapid socio-economic developments and cultural changes taking place in these countries should not be overlooked. These include the decline in the number of offspring in Asian women, older pregnancies, and shorter lactation (Porter, 2008).

In spite of the relationship between the above factors, the interpretation of such studies should be cautious. As, in addition to the epidemiological risk factors of breast cancer, the inherent constraints of ecological studies should also be taken into account. In

sum, the incidence and mortality rate of breast cancer has increased in many countries. Early prevention and epidemiological studies, timely treatment, follow-up of patients with breast cancer can be a step further in reducing the incidence of these diseases.

5. CONCLUSIONS

To conclude, the incidence of breast cancer rises with the increase in the level of the HDI in Asia. On the other hand, the observed correlation between incidence rates and education level, gross national income and life expectancy may indicate that screening and early detection of the disease were higher in Asian countries than in countries with low HDI. There may be risk factors associated with higher incidence rates in these countries.

Conflict of interest

This research has no conflict of interest for other authors.

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Code of Ethics

IR.KMU.REC.1398.276

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List of abbreviation

HDI: Human development Index

NCDs: Non-communicable diseases

GNI: Gross national income per 1000 capita

MYS: Mean years of schooling

LEB: Life expectancy at birth

LYS: Expected years of schooling

ASIR: Age Standard Incidence Rate

ASMR: Age Standard Mortality Rate

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